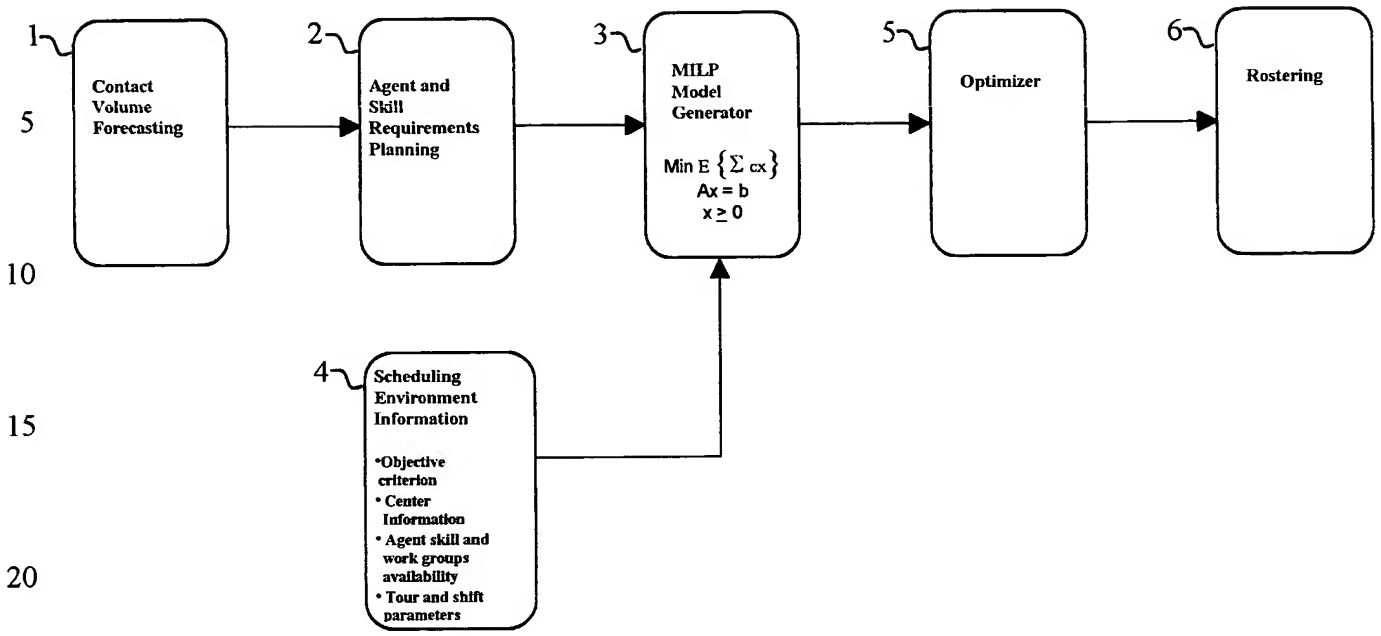
1
Contact Volume Forecasting
2
Agent and Skill Requirements Planning
3
MILP Model Generator
Min E $\{\Sigma cx\}$
Ax = b
x ≥ 0
5
Optimizer
6
Rostering
4
Scheduling Environment Information
•Objective criterion
• Center Information
• Agent skill and work groups availability
• Tour and shift parameters

FIG. 1

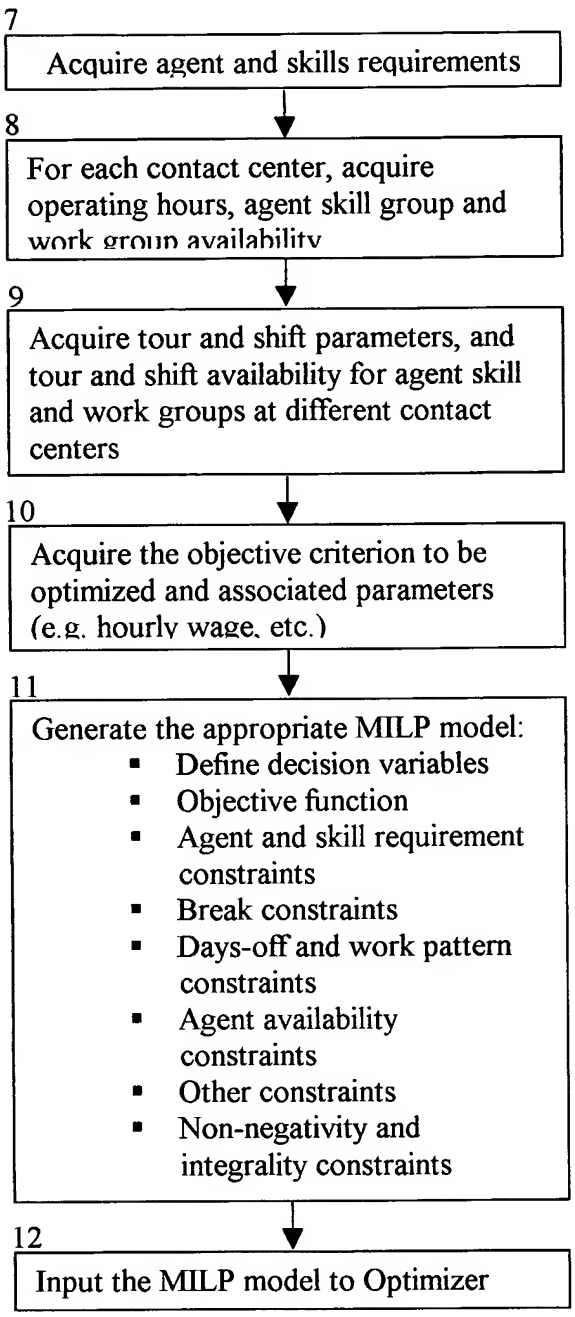
7
Acquire agent and skills requirements
8
For each contact center, acquire operating hours, agent skill group and work group availability
9
Acquire tour and shift parameters, and tour and shift availability for agent skill and work groups at different contact centers
10
Acquire the objective criterion to be optimized and associated parameters (e.g. hourly wage, etc.)
11
Generate the appropriate MILP model:
Define decision variables
Objective function
Agent and skill requirement constraints
Break constraints
Days-off and work pattern constraints
Agent availability constraints
Other constraints
Non-negativity and integrality constraints
12
Input the MILP model to Optimizer

FIG. 2

FIG. 3

Number of Days-off (13)	Number of Consecutive Days-off (14)	1	2	3	4	5	6	7 (15)
0	0	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1
	1	1	0	1	1	1	1	1
	1	1	1	0	1	1	1	1
	1	1	1	1	0	1	1	1
	1	1	1	1	1	0	1	1
	1	1	1	1	1	1	0	1
	1	1	1	1	1	1	1	0
2	2	0	0	1	1	1	1	1
	2	1	0	0	1	1	1	1
	2	1	1	0	0	1	1	1
	2	1	1	1	0	0	1	1
	2	1	1	1	1	0	0	1
	2	1	1	1	1	1	0	0
	2	0	1	1	1	1	1	0
	1	0	1	0	1	1	1	1
	1	0	1	1	0	1	1	1
	1	0	1	1	1	0	1	1
	1	0	1	1	1	1	0	1
	1	1	0	1	0	1	1	1
	1	1	0	1	1	0	1	1
	1	1	0	1	1	1	0	1
	1	1	0	1	1	1	1	0
	1	1	1	0	1	0	1	1
	1	1	1	0	1	1	0	1
	1	1	1	0	1	1	1	0
	1	1	1	1	0	1	0	1
	1	1	1	1	0	1	1	0
	1	1	1	1	1	0	1	0
3	3	0	0	0	1	1	1	1
	3	1	0	0	0	1	1	1
	3	1	1	0	0	0	1	1
	3	1	1	1	0	0	0	1
	3	1	1	1	1	0	0	0
	3	0	1	1	1	1	0	0
	3	0	0	1	1	1	1	0
	2	0	0	1	0	1	1	1
	2	0	0	1	1	0	1	1
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	2	1	0	0	1	0	1	1
	2	1	0	0	1	1	0	1
	2	1	0	0	1	1	1	0
	2	1	1	0	0	1	0	1
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	2	0	1	1	0	0	1	1
	2	1	0	1	0	0	1	1
	2	0	1	1	1	0	0	1
	2	1	0	1	1	0	0	1
	2	1	1	0	1	0	0	1
	2	1	0	1	1	1	0	0
	2	1	1	0	1	1	0	0
	2	1	1	1	0	1	0	0
	2	0	1	0	1	1	1	0
	2	0	1	1	0	1	1	0
	2	0	1	1	1	0	1	0
	1	0	1	0	1	0	1	1
	1	0	1	0	1	1	0	1
	1	0	1	1	0	1	0	1
	1	1	0	1	0	1	0	1
	1	1	0	1	0	1	1	0
	1	1	0	1	1	0	1	0
	1	1	1	0	1	0	1	0
4	4	0	0	0	0	1	1	1
	4	1	0	0	0	0	1	1
	4	1	1	0	0	0	0	1
	4	1	1	1	0	0	0	0
	4	0	1	1	1	0	0	0
	4	0	0	1	1	1	0	0
	4	0	0	0	1	1	1	0
	3	0	0	0	1	0	1	1
	3	0	0	0	1	1	0	1

FIG 3. (Cont'd)

	3	1	0	0	0	1	0	1
	3	1	0	0	0	1	1	0
	3	1	1	0	0	0	1	0
	3	0	1	0	0	0	1	1
	3	0	1	1	0	0	0	1
	3	1	0	1	0	0	0	1
	3	1	0	1	1	0	0	0
	3	1	1	0	1	0	0	0
	3	0	1	0	1	1	0	0
	3	0	1	1	0	1	0	0
	3	0	0	1	0	1	1	0
	3	0	0	1	1	0	1	0
	2	0	0	1	0	0	1	1
	2	0	0	1	1	0	0	1
	2	1	0	0	1	0	0	1
	2	1	0	0	1	1	0	0
	2	1	1	0	0	1	0	0
	2	0	1	0	0	1	1	0
	2	0	1	1	0	0	1	0
	2	0	0	1	0	1	0	1
	2	1	0	0	1	0	1	0
	2	0	1	0	0	1	0	1
	2	1	0	1	0	0	1	0
	2	0	1	0	1	0	0	1
	2	1	0	1	0	1	0	0
	2	0	1	0	1	0	1	0
5	5	0	0	0	0	0	1	1
	5	1	0	0	0	0	0	1
	5	1	1	0	0	0	0	0
	5	0	1	1	0	0	0	0
	5	0	0	1	1	0	0	0
	5	0	0	0	1	1	0	0
	5	0	0	0	0	1	1	0
	4	0	0	0	0	1	0	1
	4	1	0	0	0	0	1	0
	4	0	1	0	0	0	0	1
	4	1	0	1	0	0	0	0
	4	0	1	0	1	0	0	0
	4	0	0	1	0	1	0	0
	4	0	0	0	1	0	1	0
	3	0	0	0	1	0	0	1
	3	1	0	0	0	1	0	0
	3	0	1	0	0	0	1	0
	3	0	0	1	0	0	0	1
	3	1	0	0	1	0	0	0
	3	0	1	0	0	1	0	0
	3	0	0	1	0	0	1	0
6	6	0	0	0	0	0	0	1
	6	1	0	0	0	0	0	0
	6	0	1	0	0	0	0	0
	6	0	0	1	0	0	0	0
	6	0	0	0	1	0	0	0
	6	0	0	0	0	1	0	0
	6	0	0	0	0	0	1	0
7		0	0	0	0	0	0	0

5

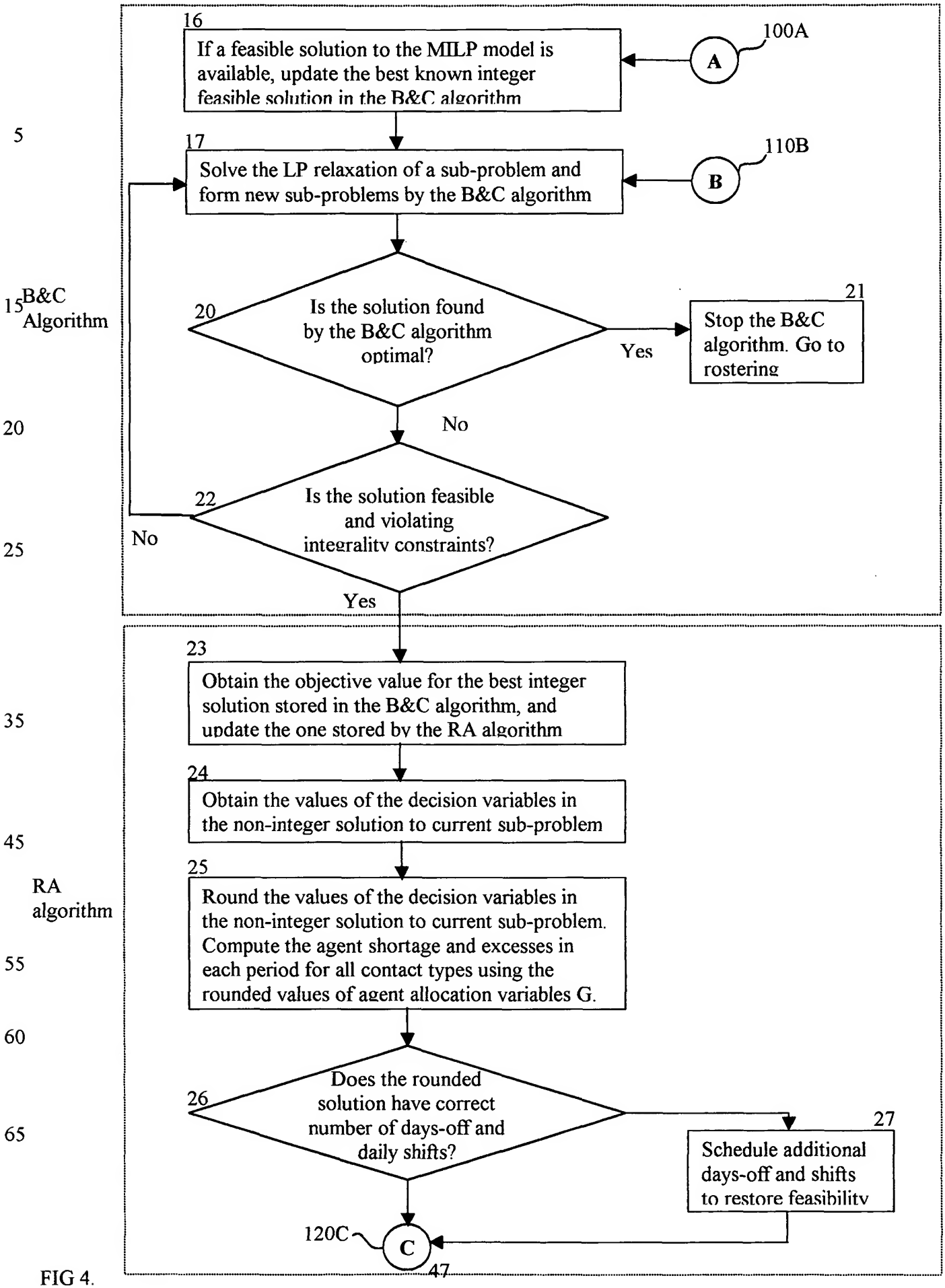
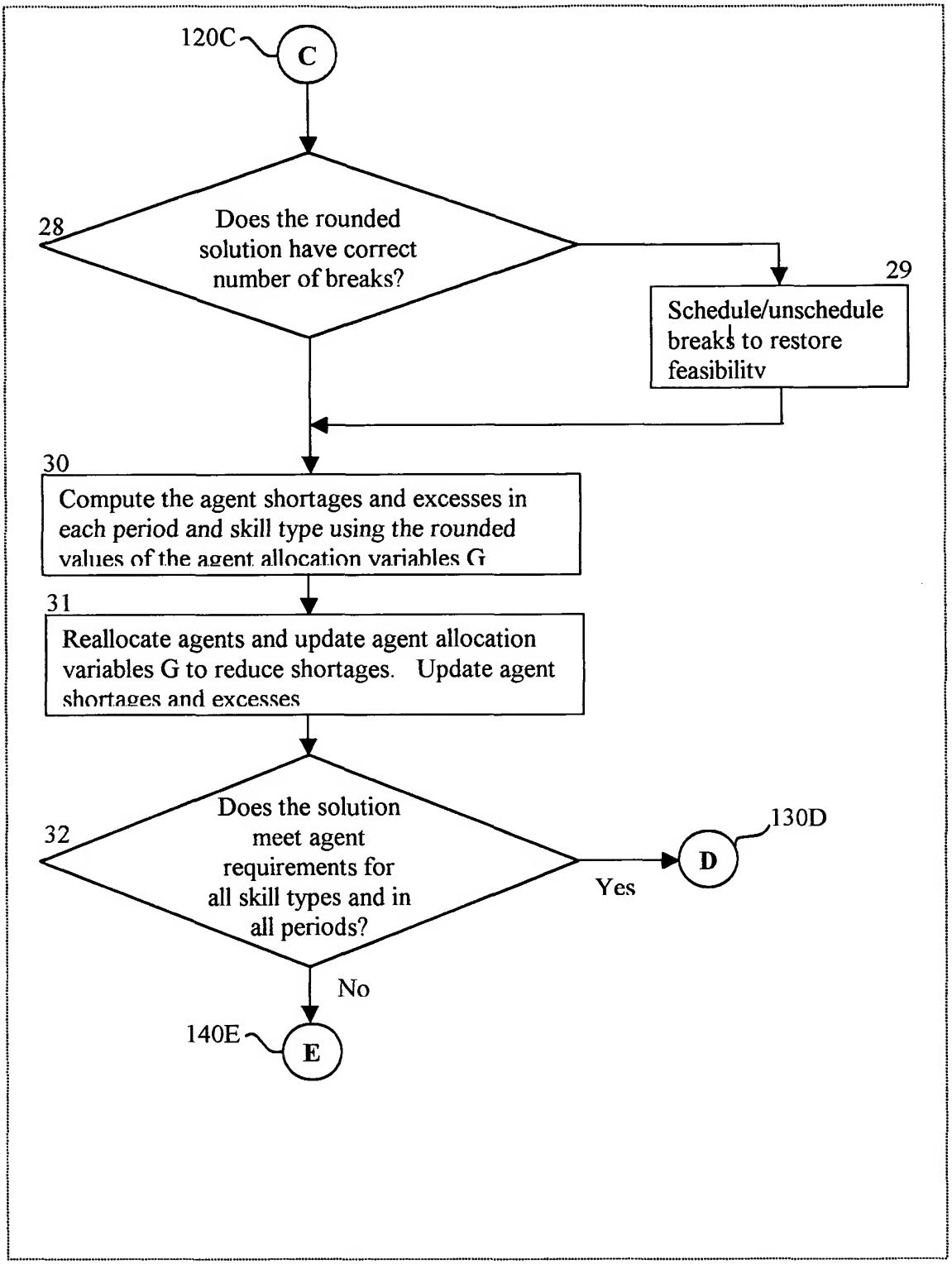

16
If a feasible solution to the MILP model is available, update the best known integer feasible solution in the B&C algorithm
100A
A
17
Solve the LP relaxation of a sub-problem and form new sub-problems by the B&C algorithm
110B
B
B&C Algorithm
20
Is the solution found by the B&C algorithm optimal?
Yes
21
Stop the B&C algorithm. Go to rostering
No
22
Is the solution feasible and violating integrality constraints?
No
Yes
23
Obtain the objective value for the best integer solution stored in the B&C algorithm, and update the one stored by the RA algorithm
24
Obtain the values of the decision variables in the non-integer solution to current sub-problem
25
Round the values of the decision variables in the non-integer solution to current sub-problem. Compute the agent shortage and excesses in each period for all contact types using the rounded values of agent allocation variables G.
RA algorithm
26
Does the rounded solution have correct number of days-off and daily shifts?
27
Schedule additional days-off and shifts to restore feasibility
120C
C
47

FIG 4.



RA algorithm

FIG 4.

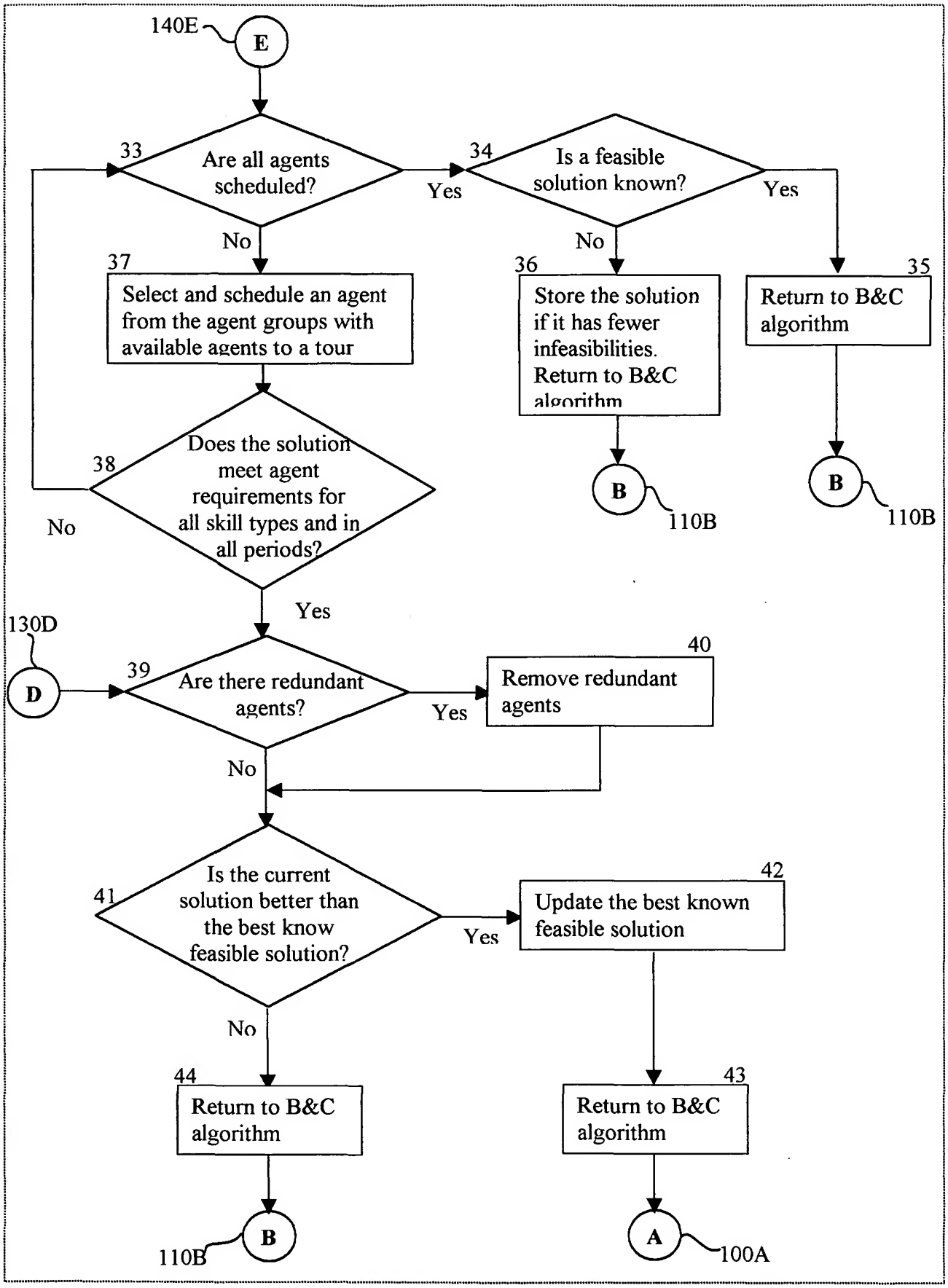

140E
E
33
Are all agents scheduled?
Yes
34
Is a feasible solution known?
Yes
No
No
37
Select and schedule an agent from the agent groups with available agents to a tour
36
Store the solution if it has fewer infeasibilities. Return to B&C algorithm
35
Return to B&C algorithm
B
110B
B
110B
38
Does the solution meet agent requirements for all skill types and in all periods?
No
Yes
RA algorithm
130D
D
39
Are there redundant agents?
Yes
40
Remove redundant agents
No
41
Is the current solution better than the best know feasible solution?
Yes
42
Update the best known feasible solution
No
44
Return to B&C algorithm
43
Return to B&C algorithm
B
110B
A
100A

FIG 4.